

SPECIFICATION AMENDMENTS

On page 1, above line 1, insert the following new paragraph:

5 “This Application is a National Stage entry under §371 of PCT Application PCT/EP03/03244, filed March 27, 2003, which claims priority to U.S. Provisional Application 60/368,066, filed March 27, 2002.”

Replace the paragraph at page 1, lines 1-4, with the following paragraph:

10 “The present invention pertains to a process for combusting coke of a coke-containing ~~FCC~~ fluid catalytic cracking (FCC) unit in a regeneration unit of a FCC unit and to a corresponding apparatus for performing said process.”

Replace the paragraph at page 1, lines 5-18, with the following paragraph:

15 “Fluidized catalytic cracking (FCC) processes operate by circulating catalyst particles continuously from a reactor in which a hydrocarbon feed is cracked to lower boiling products, during which ~~cracking~~ carbonaceous material is deposited on the catalyst. The catalyst is then passed to ~~via~~ a regenerator in which the carbonaceous material is combusted to restore the catalyst activity, to

20 heat up the catalyst (necessary to supply heat for the endothermic cracking reactions on the reactor side) and returning catalyst particles to the reactor. Such a process and reactors for performing these processes are known in the art. Reference is made to Robert A. Meyers, Handbook of Petroleum Refining Processes, McGraw-Hill (1996), particularly Part 3, pp. 3.3-3.112.”

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Replace the paragraph at page 1, line 25 to page 2, line 10, with the following paragraph:

 “In this combustion process, inevitably the catalyst is irreversibly damaged. This damage is accelerated by high temperatures, high steam partial pressure

30 and by certain contaminants (principally vanadium- and nickel-containing compounds), which stem from the hydrocarbon feedstock and which are deposited on the catalyst during the cracking reactions. In order to maintain the catalytic activity at a certain level, it is customary to replace a certain amount of

the catalyst inventory from the unit ~~by~~ with fresh catalyst on a regular basis. The term "regular" in this context refers to the frequency with which this replacement is carried out. Depending on the degree of automation of the FCC unit, the time interval between catalyst replacements may vary from a few minutes to a few days."

Replace the paragraph at page 2, lines 21-30, with the following paragraph:

"It is more difficult to regulate temperature and steam partial pressure in the regenerator. The regenerator temperature is not ~~a practical instrument~~ simple to control in this respect, since this is dictated by the heat balance of the unit (the heat requirements on the reactor side). Steam partial pressure likewise is not simple to control. A large amount of the steam in the regenerator is a co-product of the combustion reactions and hence is dictated by the amount of coke burnt, which again is dictated by the heat balance of the unit."

Replace the paragraph at page 3, lines 23-29, with the following paragraph:

"The present invention has ~~to~~ as its object to provide improved combustion of coke at low hydrothermal deactivation, which is suitable in any regenerator, including in a one-stage regenerator. The invention relates to a method and an apparatus wherein oxygen-containing gas, preferably air, is cooled before introduction into the regeneration unit."

Replace the paragraph at page 4, lines 5-10, with the following paragraph:

"The cooling unit allows the gas transport unit to transport more gas (in terms of weight) to the regeneration unit, thereby increasing the capacity of the regeneration process. Adding a cooling step to an existing FCC regenerator process is thus a method to increase the capacity of such ~~an~~ a unit."

Replace the paragraph at page 5, lines 6-15, with the following paragraph:

"In yet another aspect the invention pertains to an apparatus for performing the above process comprising a reactor unit with inlet and outlet means, a regenerator unit with inlet means that are connected to the outlet means of the reactor unit and outlet means that are connected to the inlet means of the reactor unit, characterized in that the apparatus further comprises a gas transport unit

located in or at inlet means of the regenerator unit, and a cooling unit in the transport unit or upstream of the transport unit at its suction side.”

Replace the paragraph at page 5, lines 16-18, with the following paragraph:

5 “The invention is further described in the following Figures, ~~without~~
~~construing these Figures as to limit the invention in any way.~~”

Replace the paragraph at page 5, line 21 – page 6, line 22, with the following paragraph:

10 “In FIG. 1 a reactor unit (not shown) forms a cycle with regenerator unit 2. The fluid catalyst is continuously ~~is~~ transferred from reactor unit 1 to regenerator unit 2, and from regenerator unit 2 back to reactor unit 1 through inlet and outlet means 3, 4, 5. Through inlet means 6 air (or another oxygen-containing gas) is introduced into the regenerator unit 2 for use as oxygen source in the coke
15 combustion. Regenerator unit 2 and reactor 1 are kept ~~on~~ at the required temperature and pressure with means that are commonly used in these processes. Air is continuously introduced by using gas transport unit 7, ~~which~~
~~upstream~~ There is provided ~~with~~ a cooling unit 8 upstream of transport unit 7. Transport unit 7 is preferably an air blower such as known to the skilled person,
20 for instance from Perry's Chemical Engineers' Handbook; 6th Edition (1984). See pages 6-24, which deal with rotary blowers. This is the type of machine that preferably is used to compress FCC air. The air that is ~~sucked~~ introduced is cooled by using a cooling unit 8. The cooling unit 8 is preferably located upstream at the suction side of the blower 7, but in other types of gas transport units 7
25 cooling may also be performed within the gas-transport unit 7. Between cooling unit 8 and gas transport unit 7 a separation vessel 10 is present to separate water via 11 from the cooled air. Among the cooling units 8 that may be used are conventional industrial chillers, for instance those as have been described in Perry's Chemical Engineers' Handbook; 6th Edition (1984); pages 11-28. These
30 chillers may be referred to as refrigeration machines. The energy for these machines can be either provided by a steam turbine or electrically. It will depend on local refinery conditions which form of energy supply is the preferred route. Usually these machines are cooled by cooling fluids such as freon or ammonium. Cooling machines that use water as coolant may also be used.”

Replace the paragraph at page 6, lines 23 - 25, with the following paragraph:

“The regenerator 2 in Figure 1 is also provided with a dense fluidized bed 12, cyclone separators 13 and gas outlet 14.”

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Replace the paragraph at page 6, line 26 – page 7, line 10, with the following paragraph:

“The process of the invention typically provides temperature differentials from 35 to 10.degree. C. The effect is the greatest in summer and in countries with a hot (humid) climate. Preferably the temperature of the air before being cooled is higher than 25.degree. C., more preferably higher than 30.degree. C. The advantages of the invention are especially found when the content of water in air before cooling is between 50 and 100% and preferably between 75 100% of total saturation (humidity). The following is an illustrative example of the benefits of this invention. In a unit with a feed intake of 16,000 t/d (tons/day) (typical coke burn rate=870 t/d; typical catalyst make-up rate=7 t/d): the reduction in catalyst make-up rate reduction during the summer months would be 0.8 t/d; and during the winter months: 0.2 t/d. The yearly average reduction in catalyst make-up rate is 0.4 t/d; corresponding to roughly ~~300,000 \$/year~~ \$300,000 per year savings of catalyst consumption.”

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